Journal of the Lepidopterists' Society
57(2), 2003, 113–120

FIRST RECORD OF LARVAL ENDOPHAGY IN EULIINI (TORTRICIDAE): A NEW SPECIES OF *SETICOSTA* FROM COSTA RICA

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ABSTRACT. ***Seticosta rubicola*, new species**, is described and illustrated from Costa Rica. The species is assigned provisionally to *Seticosta* on the basis of superficial similarities to other species in the genus (e.g., forewing length and pattern, long antennal cilia in the male, and extremely elongate labial palpi in both sexes), as well as features of the genitalia (e.g., "trifurcate" uncus). The absence of long, strong setae from the costa of the valva in the male genitalia is the only character contradicting this placement, and the setae are assumed to be lost secondarily. *Seticosta* is assigned to Euliini on the basis of the shared possession of a uniquely derived foreleg hairpencil in the male. Larvae of the new species are endophagous feeders in the stems of *Rubus* spp. (Rosaceae), which represents the first reported case of gall-inducing or stem-boring in Euliini. Larvae also have been reported as borers in the fruit of *Rubus*. The early stages of *S. rubicola*, the first reported for the genus, are described and illustrated. They are unusual in the possession of several features more characteristic of Olethreutinae than of Tortricinae. The species has been recognized as a pest of quarantine significance by the Ministerio de Agricultura, Costa Rica.

RESUMEN. Una nueva especie de mariposa nocturna, *Seticosta rubicola*, ha sido descrita e ilustrada desde Costa Rica. La especie ha sido asignada provisionalmente al género *Seticosta*, basándose en similitudes superficiales con otras especies del género, así como en caracteres de la genitalia. Algunas de estas similitudes son: longitud y el patrón de colores de las alas anteriores, cilio antenal largo en machos, palpos labiales extremadamente largos en ambos sexos, y presencia de un penacho de pelos en las patas anteriores de los machos. La ausencia de setas gruesas en la costa de la valva en la genitalia del macho es la única característica que contradice esta ubicación taxonómica, y se asume que las setas se perdieron secundariamente. El género *Seticosta* está asignado dentro de Euliini basándose en la presencia de un penacho de pelos distintivo en las patas delanteras del macho. Las larvas de esta nueva especie son formadoras de agallas en los tallos de especies de Mora (*Rubus*; Rosaceae). Los estadios tempranos de la *Seticosta rubicola*, primer registro para el género, son descritos e ilustrados. Estos son inusuales debido a la posesión de varios caracteres que son distintivos de Olethreutinae más que de Tortricinae.

Additional key words: Neotropical, systematics, *Rubus* spp., life history, pest species, *Seticosta rubicola*, taxonomy, parasitoid, *Bassus* new species, biological control.

Although endophagous feeding and gall-induction is not unusual in the subfamily Olethreutine (Tortricidae), it is relatively rare in Tortricinae, where it is restricted primarily to the tribe Cochylini. Hence, it is fairly surprising that during investigations on gall-inducing Lepidoptera in Costa Rica, the second author discovered several species of Tortricinae causing galls in *Rubus* species (Rosaceae). One in particular, an undescribed species provisionally assigned to *Seticosta*, is especially unusual in its larval chaetotaxy and other features. Larvae identical to these, and assumed to be conspecific, also have been intercepted by the U.S. Department of Agriculture's Plant and Animal Health Inspection Service at U.S. ports-of-entry within the fruit of *Rubus* spp. from Guatemala. In addition, this species recently was identified as a pest of quarantine significance by the Ministerio de Agricultura, Costa Rica.

Food plants of the tribe Euliini, to which *Seticosta* belongs, were reviewed by Brown and Passoa (1998), who identified no previously recorded endophagous-feeding species in the tribe. We take this opportunity to describe and illustrate this new species from Costa Rica, present details on the morphology of the early stages, and comment briefly on its unusual life history.

Materials and Methods

Adults were borrowed from or examined at the following institutions: Instituto Nacional de Biodiversidad, Santo Domingo de Heredia, Costa Rica (INBio); Essig Museum of Entomology, University of California, Berkeley, California, U.S.A. (UCB); Museo de Insectos, Escuela de Biología, Universidad de Costa Rica, San José (UCR); National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A. (USNM); and Vitor Becker personal collection, Planaltina, Brazil (VBC). Dissection methodology follows that summarized in Brown and Powell (1991). Illustrations of genitalia are photographs of slide mounts taken with a SONY DKC5000® digital camera and enhanced using Adobe Photoshop® and Adobe Illustrator® software. Forewing measurements were made with the aid of an ocular micrometer mounted in a Wild M3Z dissecting microscope under low power (×10–16). Terminology for wing venation and genitalic structures follows Horak (1984); terminology for larval

features follows Brown (1987). Abbreviations and symbols are as follows: FW = forewing; HW = hindwing; DC = discal cell; n = number of specimens examined; $\bar{x}$ = mean; ca. = circa (approximately); Est. = Estacion; r.f. = reared from.

Larvae were obtained primarily during field work conducted between February 2000 and June 2001, along dirt trails near La Georgina, Villa Mills (3000–3100 m) and Estación Biológica Cerro de la Muerte (3050–3100 m) at Cerro de la Muerte, Cartago and San José provinces, Costa Rica. The vegetation of the region is referred to as Tropical Montane Cloud Forest. During the dry season, which lasts from December/January through April, rain is infrequent, although humidity remains high, and dense fog is common in the afternoons. During the wet season, which lasts from April through November/December, heavy rains are common; average annual rainfall is 2812 mm. Daily average temperature is 10.9°C, but temperatures can be as low as –3°C during the dry season (Kappelle 1996).

During field work, individuals of various species of *Rubus* were examined for galls (e.g., larval frass and swollen parts of stems). When discovered in the field, some larvae, along with their galls and additional freshly-cut stems of the food plant, were placed in plastic bags and taken to the laboratory where they were either stored in an air-conditioned room (approximately 16–18°C) at Museo de Los Insectos, Universidad de Costa Rica, in San Pedro (1150 m), or placed in a refrigerator (6.2°C) and removed and kept at ambient temperature (approximately 23°C) for 8 hours each day. Other active galls were reared under field conditions in plastic bags at the station, where temperatures ranged from 11–18°C during the day and 1–3°C at night.

Examples of galls, larvae, and pupae were preserved in 75% EtOH and are deposited in the USNM and UCR. Adult specimens were pinned, and pupal shells were saved in gelatin capsules pinned along with the adult moths. Parasitoids were submitted to Michael Sharkey for identification.

SYSTEMATICS

Seticosta rubicola Brown & Nishida, new species

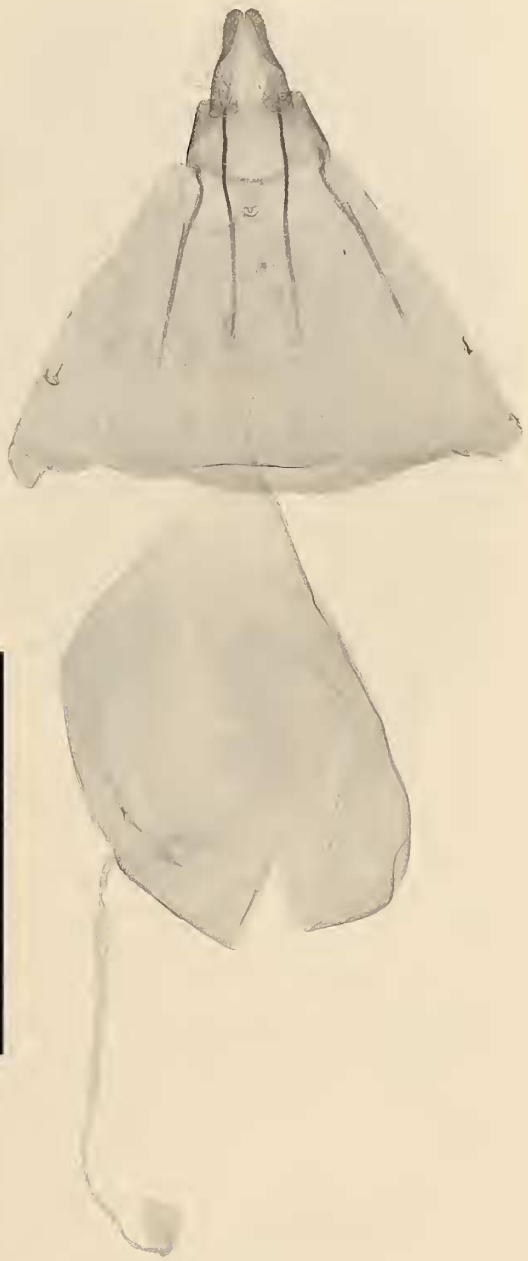
(Figs. 1–8)

Diagnosis. In forewing pattern, *S. rubicola* is extremely similar to many other species of *Seticosta*, including *S. aeolozona* (Meyrick) (Clarke 1958), *S. arachnogramma* (Meyrick) (Clarke 1958), *S. tridens* Razowski, and *S. tambomachaya* Razowski. These species typically have a somewhat uniform tan, brownish, or reddish ground color divided by a light subterminal fascia paralleling the termen, and a similarly colored diagonal subbasal fascia, extending outward from the costa. Additional external features that *S. rubicola* shares with other *Seticosta* are the extremely elongate labial palpi in both sexes, the long antennal cilia of the male, and the male foreleg hairpencil (presumably lost secondarily in related genera such as *Anopinella* Powell, *Strophotina* Brown, and *Punctapinella* Brown). The male of *S. rubicola* lacks the dense patch of strong setae from the costa of the valva characteristic of all other species of *Seticosta*, and it is assumed that this character is lost secondarily. The male of the new species possesses a pair of lateral processes near the distal end of the uncus giving it a trifurcate appearance, which appears to define a species group within *Seticosta* that includes *S. arachnogramma* (Clarke 1958), *S. tridens* (Razowski 1988), *S. cerussograpta* Razowski, and one or more undescribed species; this character state is less developed or absent in other species such as *S. homosacta* (Meyrick) and *S. sagmatica* (Meyrick).

Description. Adult. Male (Fig. 3). Head: Frons smooth-scaled, pale cream; vertex slightly roughened, pale cream; labial palpus extremely elongate, all segments combined ca. 3 times horizontal diameter of compound eye, pale cream on inner surface, pale cream scales tipped with brown on outer surface; antennal cilia 4–5 times width of flagellomere. Proboscis present, presumably functional. Thorax: Forewing length 8.0–11.6 mm ($\bar{x}$ = 9.9; n = 11); ground color brick red, with diffuse area of darker scaling near middle of wing; costa with short, irregular, transverse, white and brown striae; a white fascia parallel to termen, overscaled with yellow-green; a second white fascia with yellow-green overscaling extending outward from costa ca. 0.2 distance from base to apex; a small blotch of white with yellow-green overscaling at lower half of base of FW; aforementioned fasciae and basal blotch connected by narrow line along lower edge of FW; fringe brick red. Underside grayish. Hindwing white, with faint, pale gray mottling. Abdomen: Somewhat shiny cream white; an indistinct brownish dot near mid-venter of A3–7. Genitalia as in Fig. 1 (photograph of JWBrown slide 1260; 5 preparations examined). Uncus bearing a pair of subdistal pointed processes, giving a trifurcate appearance; socii moderately short, digitate, sparsely setose; gnathos weak, broadly u-shaped, without conspicuous terminal process at junction of arms; transtilla moderately large, slightly narrowed and sclerotized near middle, where it bears microtrichiae; valva thick, somewhat swollen, weakly lanceolate, with rounded apex, sacculus weakly developed, confined to basal one-third of valva, cuculluslike region of dense, large setae in ventral half beyond sacculus and in apical region, costa with basal excavation bearing tiny setae. Aedeagus moderately small, curved, attenuate distally, with rounded phallobase and protruding lobe at ductus ejaculatoris; cornuti absent.

Female. Head, Thorax: Essentially as described for male, except antennal cilia unmodified (inconspicuous). Forewing length 9.2–11.1 mm ($\bar{x}$ = 10.5; n = 8). Abdomen: Essentially as described for male. Genitalia as in Fig. 2 (photograph of UCB slide 2516; 12 preparations examined). Papillae anales slender; apophyses anteriores and posteriores elongate, posteriores ca. 1.2 longer than anteriores; sterigma slightly variable, either totally unsclerotized or with posterior edge bearing a pair of weak subventral sclerotizations; ostium extremely simple, not surrounded by sclerotization; ductus

1



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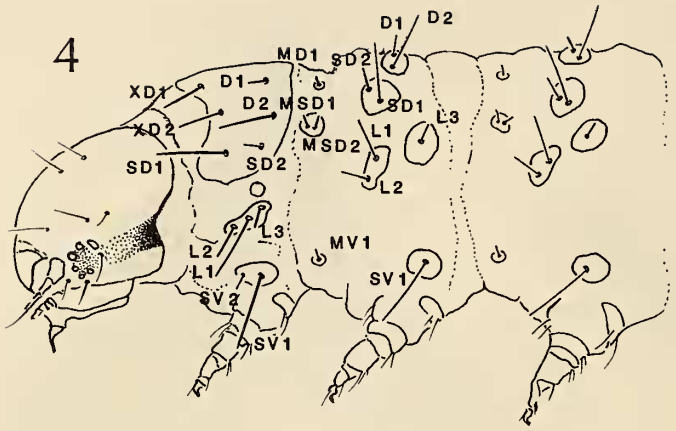
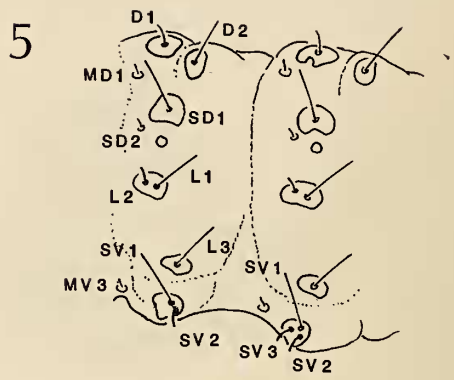
3

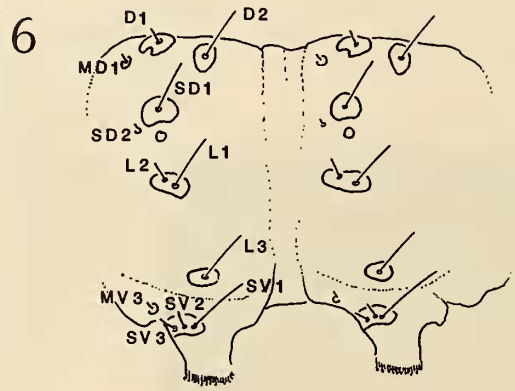
FIGS. 1–3. *Setisota rubicola*. **1,** Adult male; **2,** Male genitalia, valvae spread, aedeagus removed; **3,** Female genitalia.

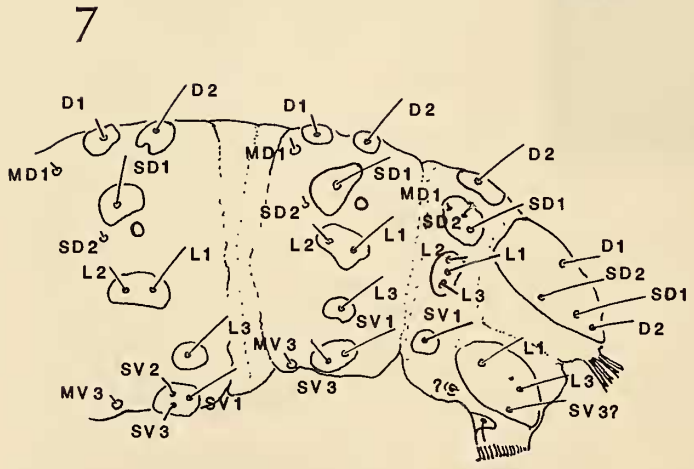
bursae moderately long, frail, slender at ostium, gradually widening anteriorly, with ductus of accessory bursae originating ca. 0.1 distance from ostium to junction with corpus bursae; corpus bursae somewhat rounded-triangular, with ductus seminalis originating in posterior third of corpus; corpus bursae with dense, extremely minute spinules throughout.

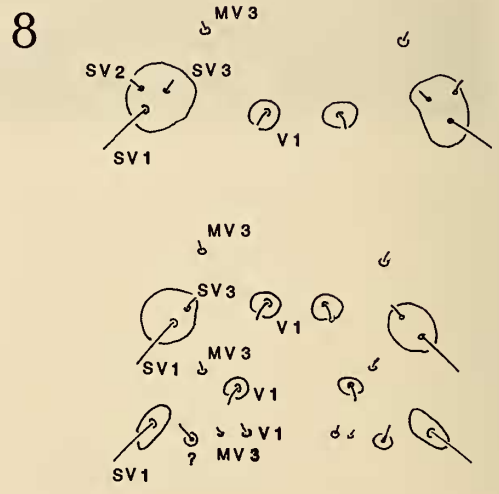
Larva (Figs. 4–8). Based on two fourth instars and one third instar collected 9 May 2001, two second instars collected 11 April 2000, one fifth instar collected 31 May 2001, and two fifth instars collected 20 July 2001, at Estación Biologica Cerro de la Muerte, 3050 m, Provincia San Jose, Costa Rica, on *Rubus vulcanicola* (Donn. Sm.) Rybd. General: Length 12–13 mm (fifth instars only); head black (in early instars) to orange with conspicuous black genal and stemmatal patches (later instars); body maroon (paler in mature larva of each stage), with moderately large, conspicuous, darker, brownish pinacula; prothoracic and abdominal shields brownish yellow to reddish brown, with pattern of pale brown specks; integument strongly granular; spiracles moderately large, rounded, those on T1 and A8 larger than others. Thorax: Prothoracic shield with broad, translucent region immediately anterad of line formed by XD1, XD2, and SD1; L-group trisetose on T1, with pinaculum irregularly oblong-round, situated mostly ventrad of spiracle, L1 roughly equidistant from L2 and L3; SV-group on T1–3 is 2:1:1; meso- and metathorax weakly annulate dorsally, both segments with first annulation bearing an extra SD1 seta (=MD1), an extra pair of L setae (=MSD1, MSD2), an extra SV seta











FIGS. 4–8. Larval chaetotaxy of *Seticosta rubicola*. **4,** Head and thorax, lateral view; **5,** First and second abdominal segments, lateral view; **6,** Fourth and fifth abdominal segments, lateral view; **7,** Seventh, eighth, ninth, and tenth abdominal segments, lateral view; **8,** Seventh, eighth, and ninth abdominal segments, ventral view, anterior end at top.

(=MV1), and an extra V seta on smaller, less conspicuous pinacula. Abdomen: D1 pinacula usually with a deep notch at ventro-anterior margin, at least on A2–5 (sometimes on more segments); extra, tiny D seta (=MD1) and V seta (=MV3) situated near anterior edge of segments A1–9; SD1 located dorsad of spiracle on A1–7, with tiny SD2 remote, ventro-anterad, usually without pinaculum; L1 and L2 on same enlarged pinaculum on A1–8; SD1 anterad of spiracle on A8; D2 setae usually on common dorsal pinaculum on A8; D2 setae always on common dorsal pinaculum on A9; D1 and SD1 on common pinaculum on A9; L-group trisetose on A9, usually with all setae on same pinaculum; SV-group on A1,2,7,8,9 is 2(3):3:2(3):2:1; V setae ca. 2 times farther apart on A9 than on A8; anal comb present, with 3–6 teeth; crochets in biordinal circle, 22–30 (in third and fourth instars) to 28–38 (in fifth instars) on prolegs on A3–6, 14–21 on A10 (extremely variable from instar to instar).

Pupa (Fig. 9). Based on two preserved in alcohol and three exuviae (one male, two females). Typically tortricine, fusiform, 7.5–8.5 mm in length, 2.1–2.3 mm in width. Head and thorax typical for the family, as described elsewhere (e.g., Horak 1998). Abdomen with A1 lacking dorsal spines; A2 with double row of weak dorsal spines; A3–A8 with double row of sparse, strong dorsal spines; segment A9 with four large dorsal thorns. Posterior end of abdomen bluntly rounded; cremaster absent; A10 with a pair of posterolateral thorns; four long hooked setae on A10, two at posterior end, two posterolaterad.

Holotype. ♂, Costa Rica, Cartago Province, Parque Nacional Tapantí, El Guarco, San Isidro, Est. Esperanza, 2600 m, May 2001 (R. Delgado, INBio).

Paratypes (29 ♂, 16 ♀). COSTA RICA: Cartago Province: 1 km NE Cerro Asuncion, Cerro de la Muerte, 3100 m, 2 Mar 1985, D. Janzen & W. Hallwachs (1 ♂, INBio). 7.5 km S Ojo de Agua, 9°15′N, 84°48′W, 2682 m, 16 Jun 1973, Erwin & Hevel (1 ♂, USNM). Villa Mills, 3100 m, 9 Jul 1993, E. Phillips (2 ♂, INBio), 3 Jul 1999, E. Phillips & J. Powell (1 ♀, UCB). Río Macho, Est. Ojo de Agua, 3000 m, 25–26 May 1997, B. Gamboa (2 ♀, INBio & USNM). Pension La Georgina, Cerro de la Muerte, S border Cartago Province, 3000 m, 23–25 May 1985, J. Powell & P. Opler (1♂, 2 ♀, UCB). Cerro de la Muerte, 3100 m, 17 Sep 1999 (3 ♂, 3 ♀), 1–2 Sep 2000 (2 ♂, 4 ♀, VBC), V. Becker. 7 km SE El Canon, 2500 m, 28 May 1985, blacklight, J. Powell (1 ♀, UCB), 28 May 1985, ex-loose bark of live tree, J. Doyen (1 ♀, UCB). Parque Nacional Tapantí, El Guarco, San Isidro, Est. Esperanza, 2600 m, May 2001, R. Delgado (4 ♂, 1 ♀, INBio & USNM). El Guarco, Macizo de la Muerte, Sector de Esperanza, 2600 m, Jun 2001 (1 ♀, INBio), Oct 2001, R. Delgado (1 ♂, INBio). El Guarco, Villa Mills-CATIE, 2840 m, 26–28 Oct 2000, R. Delgado (2 ♂, INBio). R.F. Río Macho, El Guarco, Macizo de la Muerte, Sector de Esperanza, 2600 m, Aug 2001, R. Delgado (1 ♂, INBio). Heredia Province: Est. Barva, Braulio Carrillo N. P., 2500 m, Nov 1989, G. Rivera (1 ♂, INBio), Nov 1989 (1 ♂, INBio), May 1990 (1 ♂, INBio), A. Fernandez. Mount Poas [2350 m], no date (1 ♀, USNM), Wm. Schaus. Limón Province: Bratsi, Valle del Silencio, 2472 m, 11–12 Oct 2000, R. Delgado (1 ♂, 1 ♀, INBio). San José Province: San Gerardo de Dota, Cerro de la Muerte, 2430 m, 23 Aug 1981 (1 ♂, INBio), 23 Dec 1981, D. Janzen & W. Hallwachs (2 ♂, 2 ♀, INBio), 20 Feb 1996, D. & J. Powell (1 ♂, UCB), 5 Jul 1999, E. Phillips & J. Powell (2 ♂, UCB). Est. Cuerci, por Quebrada los Leones, 4.5–4.6 km E Villa Mills, 2500–2700 m, 21–26 Sep 1995 (1 ♂, INBio), 21–24 Oct 1995 (1 ♂, INBio), 25 Nov 1995 (1 ♂, INBio), 10–12 Oct 1996 (1 ♂, INBio), 7–10 Dec 1996, A. Picado (1 ♂, 2 ♀, INBio & USNM), 12–15 Jul 1996, B. Gamboa (2 ♀, INBio). Cerro de la Muerte, Villa Mills, 3000 m, 25 Mar 2000, r.f. *Rubus braecipus*, K. Nishida (1 ♀, UCR). Cerro de la Muerte, Est. Biologia Cerro de la Muerte, 3100 m, em: 4 Jul 2001, r.f. *Rubus vulcanicola*, K. Nishida (1 ♀, UCR). GUATEMALA: Volcan Santa Maria, [no date] (2 ♀, USNM), Schaus & Barnes. Heu., Bulej, 2000 m, 15°27′N, 91°35′W, 25 Jul 2000 (1 ♂, VBC), V. Becker.

Additional Specimen Examined. COSTA RICA: San José Province: Pérez Zeledón, 2260 m, em: May 2000, r.f. *Rubus* sp. (cultivo de mora), K. Nishida (1 ♀, UCR).

FIG. 9. Pupa of *Seticosta rubicola*. **9,** Venter (a), dorsum (b).

Distribution. *Seticosta rubicola* is known primarily from the high elevations (2000–3100 m) in the central cordillera of Costa Rica, including the provinces of Cartago, Heredia, Limón, and San José. The majority of the specimens are from the vicinity of Cerro de la Muerte, a high elevation cloud forest. Based on a few specimens records cited above and larvae intercepted at U.S. ports-of-entry on *Rubus* sp., the species also occurs in Guatemala.

Etymology. The specific epithet is derived from the association of the larvae with *Rubus*.

Remarks. The larva and pupa of *Seticosta rubicola* are the first reported for the genus. At least three characters of the larva are more typical of Olethreutinae than Tortricinae: (1) the occurrence of SD1 and D1 on a shared pinaculum on A9; (2) a bisetose SV-group on A7 (although it was trisetose on one of eight larvae examined); and (3) SD2 on a pinaculum separate from that of SD1 on A1–8. The widely separated V setae on A9 are unusual for Tortricinae as well, although this condition is present in almost all Sparganothini (MacKay 1962) and Cochylini. Other unusual features of the larva include the extra SD, L, SV, and V setae on the meso- and metathorax; the extra D and V setae on A1–8; the notched D2 pinacula of A2–5, characteristic

of the *Cryptophlebia-Ecdytolopha* group of genera (Olethreutinae: Grapholitini) (Adamski & Brown 2001); and the position of the L pinaculum on the prothorax, i.e., mostly ventrad of the spiracle. Based on previous studies on the early stages of Euliini, it appears that both the "olethruetine" and "tortricine" conditions of SD1+D1 on A9 occur in this tribe, i.e., either on a shared (olethreutine condition) or on separate pinacula (tortricinae condition). Both states are reported to occur in *Proeulia* Obraztsov and *Anopina* Obraztsov (Brown & Powell 2000). The pupa of *Seticosta rubicola*, lacking a distinct cremaster and with fewer spines in the ventral rows, is also somewhat olethreutinelike and dissimilar to that of all other Euliini reported thus far (i.e., *Accuminulia* Brown, *Anopina* Obraztsov, *Chileulia* Powell, *Cuproxena* Brown & Powell, and *Dorithia* Powell).

BIOLOGY

The eggs of *S. rubicola* are unknown. Larvae were discovered boring in stems of *Rubus eriocarpus* Liebm. and, more frequently, *Rubus vulcanicola*, inducing a fusiform gall (Fig. 10). The size of larva-containing late stage galls on the latter species is ca. 5–6 mm wide and ca. 12–15 mm long; the stem width at the base of the gall is ca. 3 mm. Galls often were situated near or between nodes of young parts of the stems, with one to four galls per stem. A single larva was found per gall chamber. At the base of the gall there is an opening (>3 mm in diameter) from which the larva ejects frass, head capsules, and other debris (Fig. 10). Apparently this opening represents the point at which the larva enters the stem (Figs. 10–12); it is usually located at the base of a leaf petiole or a shoot axis, facing upward. The opening is characterized by a patch of larval frass and debris, including head capsules and bits of the plant tissue, all of which are attached by silk. The scraps of plant tissue are made by the larva excavating the stem and by larval regurgitation. Occasionally, some larval frass is retained within the gall chamber (Fig. 13). Within the galls of early instars there usually is a silk-lined shelter, woven with frass and bits of the plant tissue.

Dissection of galls on *Rubus vulcanicola* revealed that the tissue surrounding the larval chamber is apparently parenchyma tissue. This tissue, upon which the larva feeds, is light green and consists of dense cells, resembling tissue in apical parts of the plants. In contrast, other parts of the stem were filled with white spongy tissue (Figs. 11, 13). The gall chamber was surrounded with irregular tissue (calluslike growth) or irregularly consumed tissue. The surface of the gall chamber has a brownish tint (Fig. 13) and is loosely covered with silk. When galls of later instar larvae were cut open, the larvae immediately began to seal the opening with silk, incorporating frass and debris. These galls were approximately 20 mm in length with a maximum radius of about 4 mm. In contrast, larval chambers of *Seticosta rubicola* on *Rubus eriocarpus* reached a length of approximately 40 mm, although the swelling of the stem was less conspicuous than that of galls on *R. vulcanicola*. The initiation of stem-boring can be detected by the presence of a small amount of frass near the stem apex (Fig. 12). The swelling or initiation of gall-formation can be detected less than two weeks after the initiation of boring.

When reared in plastic bags, immature larvae left the original galls and moved to the extra stems that were included in the bag. Larvae usually bored into the stem from the cut surface (Fig. 15). Three larvae completed development feeding on the stem tissue by boring (parenchyma and apparently some vascular tissues). Densely spun silk (denser than the silk spun in the gall chamber) was present on the chamber floor. The larvae bored the stem continuously, resulting in chambers slightly greater than 4 cm in length (n = 15).

In response to probing with forceps, larvae regurgitated brown liquid. Larvae also often responded to "irritation" by moving the head and the caudal part of the abdomen up and down a few times for about two seconds.

We assume that under natural conditions pupation takes place outside of the gall chamber since pupae were found in none of the older gall chambers we dissected (n = 50). Under laboratory conditions, most larvae left their galls and pupated in the plastic bag without spinning cocoons (n = 7). However, one larva pupated inside the gall chamber, spinning a thin cocoon; and two pupated in the split part of the stem, spinning cocoons with bits of the plant tissue (Fig. 15). In the latter two cases, the larvae initially left the gall chamber, presumably searched for an appropriate pupation site (i.e., wandered around in the plastic bag), and finally returned to the gall or split part of the stem. This behavior suggests that the larvae were searching for a narrow or concealed space within which to pupate. Larval development from the beginning of the third instar to pupation took about 20 days in the refrigerator (n = 4); the pupal stage required about 35 days (n = 1).

Two specimens of a parasitoid wasp, *Bassus* nr. *cingulipes* Sharkey (Braconidae: Agathidinae), were reared from a larva of *S. rubicola*. An additional female of this parasitoid was captured while it investigated a larva on *R. vulcanicola*.

The second author reared a single female of *S. rubicola* from cultivated blackberry (mora), *Rubus prae-*

FIGS. 10–15. Galls of *Seticosta rubicola* on *Rubus vulcanicola*. **10,** Gall swelling, opening "decorated" with larval frass and debris; **11,** Lateral section illustrating parenchyma tissue and spongy stem tissue; **12,** Initiation of boring near stem apex; **13,** Fifth instar boring in cut stem; **14,** Fifth instar; **15,** Cocoon spun in split part of stem.

cipuus L. H. Bailey, and larvae of *S. rubicola* have been reported as a serious pest of this crop in Pérez Zeledón, Costa Rica (Ruth León pers. com.). Parts of the stems where galls were present showed splitting tissues. Larvae identical to those from Costa Rica have been intercepted by APHIS at U.S. ports-of-entry on the fruit of *Rubus* sp. imported from Guatemala. Hence, larvae occasionally may be responsible for damaging fruit as well as stems.

In general, gall-inducing species usually require a specialized food source (i.e., a specific part of gall tissue commonly called nutritive tissue) in order to com-

plete development (Dreger-Jauffret & Shorthouse 1992). Based on gall structure and larval behavior, *S. rubicola* may be a stem-borer behaving like a gall-inducer, or a gall-inducer behaving like a stem-borer. The swellings found on the stems of *Rubus* spp. probably are induced by the mechanical damage caused by larval feeding and/or silk deposition in the chamber. The densely spun silk in the stem chamber may indicate that larvae responded to non-regrowing stem tissue, tried to induce regrowth of the tissue, or the stem tissue did not dissolve the silk.

No species of Euliini previously have been reported to have endophagous-feeding larvae. While some species are known to attack fruit (e.g., *Proeulia* Clarke, *Chileulia* Powell, *Accuminulia* Brown), larvae of these taxa are assumed (or are reported) to feed externally on the surface of the fruit. During the preparation of a systematic treatment of *Anopinella* Powell, a close relative of *Seticosta*, we discovered a species in that genus that has been reared from the fruit of *Styrax* (Styracaceae) and a second species from a fungus gall on *Inga longispina* (Fabaceae). In addition, the closely related genus *Apolychrosis* Amsel is reported to feed on the seeds of pine cones (Pogue 1986, Brown & Passoa 1998). These limited data suggest the possibility that this clade within Euliini may be adapted to internal or endophagous feeding, a unique adaptation within the Tortricinae, excluding Cochylini.

ACKNOWLEDGMENTS

We thank Jenny Phillips (INBio) and Jerry Powell (UCB) for allowing us to examine specimens in their care. The following provided information regarding the pest status of the new species in Costa Rica: Sofía Angulo Mora, Vanessa Solís Calvo, Lisseth Navarro Mora, and Ronaldo Vega, Colegio Técnico Professional de San Pablo de Léon Cortés. Illustrations of male genitalia, female genitalia, and pupa were provided by Linda Lawrence, USDA Systematic Entomology Laboratory, Washington, D.C. Illustrations of the larva were drawn by David Adamski, USDA Systematic Entomology Laboratory. The photograph of the adult was taken by Karie Darrow, Department of Systematic Biology, National Museum of Natural History, Washington, D.C. We thank Michael J. Sharkey, University of Kentucky, Lexington, for identifying the parasitoid wasps, and Ruth León G., San José, Costa Rica, for sharing information and specimens. The following provided helpful reviews of the manuscript that enhanced its clarity and quality: Paul E. Hanson (UCR); William E. Miller, University of Minnesota, St. Paul, Minnesota, U.S.A.; Norman Woodley, USDA Systematic Entomology Laboratory, National Museum of Natural History, Washington, D.C.; and Jerry Powell, University of California, Berkeley, U.S.A. We thank Federico Valverde for allowing K. Nishida to use Estación Biológica Cerro de la Muerte. Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica, and the NSF grant ALAS IV (Arthropods of La Selva) to Jack Longino, Evergreen State College, Olympia, Washington, provided funds for J. Brown to visit Costa Rica on several occasions.

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Received for publication 19 April 2002; revised and accepted 22 October 2002.